



Attorney's Docket No.: 10891-009002 / T2A-I68880C/YKY

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Kumazawa et al. Art Unit : 1752  
Serial No. : 10/801,449 Examiner : Cynthia Hamilton  
Filed : March 16, 2004  
Title : PHOTORESISTIVE COMPOSITION FOR SANDBLASTING AND  
PHOTORESISTIVE FILM USING THE SAME

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**DECLARATION OF SYUNJI NAKAZATO UNDER 37 C.F.R. 1.132**

I, Syunji Nakazato, declare as follows:

1. I am one of the named co-inventors in the subject application and am familiar with the application and the Office Action mailed July 13, 2004 in this matter.
2. I am employed by the assignee of this application, Tokyo Ohka Kogyo Co., Ltd.
3. The work described below was conducted either by me or by someone under my direct supervision.
4. The following method was performed:

A photosensitive composition layer was prepared by coating a 20 µm thick poly(ethylene terephthalate) (PET) film with a photosensitive composition solution by means of an applicator followed by drying in such a manner as to give a thickness after drying of 30 µm. Then, by pressing a polyethylene film with 20 µm thickness on the photosensitive composition layer by means of a rubber roller with care of not leaving air bubbles, a photosensitive film for sandblast use was prepared. The polyethylene film of this photosensitive film was stripped off, and the exposed photosensitive composition layer was laminated on a glass plane heated to 80°C by

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means of a rubber roller. After a test pattern mask (a mask having patterns of 30, 40, 50, 60, 70, 80, 90 and 100  $\mu\text{m}$  sizes) was brought into contact with the photosensitive composition layer, exposure to ultraviolet light was conducted with a super high pressure mercury lamp to give an irradiation amount of 150  $\text{mJ/cm}^2$ . In succession, the layer was developed with a 0.2% sodium hydrogen carbonate aqueous solution under a spray pressure of 1.5  $\text{kgf/cm}^2$  for 1.5 times as long as the break point, which is defined by the time in which the unexposed portion of the photosensitive composition layer is completely eliminated via development to give patterns.

5. Next, the resistance of the pattern to sandblasting was evaluated as follows. The polyethylene film was stripped off, and the bare photosensitive composition layer was laminated on a glass substrate preheated to 80  $^\circ\text{C}$  by means of a rubber roller, the PET film was then stripped off, and the entire surface of the photosensitive composition layer was exposed to light emitted from an ultrahigh-pressure mercury lamp at an irradiation amount of 150  $\text{mJ/cm}^2$  and subjected to sandblasting with an abrasive of glass beads #800 (produced by Alps Engineering) at a blasting pressure of  $1.96 \times 10^2 \text{ Pa}$  ( $2.0 \text{ kgf/cm}^2$ ) from a sandblast nozzle located at a distance of 80 mm. The time required for the cured resin layer to disappear by abrasive wear was measured.

6. The compositions and results obtained are set forth in the following table,  
 Table 1:

**Table 1**

		Composition (1)	Composition (2)	Comparative Composition (3)	Comparative Composition (4)
Photosensitive Composition	Acrylic copolymer	Acrylic (1) 250 parts by weight	Acrylic (2) 250 parts by weight	Acrylic (1) 250 parts by weight	Acrylic (2) 250 parts by weight
	Urethane	Urethane (1) 60 parts by weight		Urethane (2) 60 parts by weight	
	Monomer		polyethylene glycol dimethacrylate ( $n = 9$ ) 20 parts by weight		
	Initiator		2,2-dimethoxy-2-phenylacetophenone 2 parts by weight		
	Inhibitor		N-nitrosophenylhydroxylamine aluminum 0.01 parts by weight		
	Dye		Malachite Green 0.2 parts by weight		
Sandblasting evaluation	Sandblasting Resistance	O	X	X	X
	Layer Disappearance time	150 sec	60 sec	40 sec	50 sec
Developability	Break point = B. P. 20 sec.	O	O	O	A
	Development time = B. P. x 1.6	80 sec	40 sec	40 sec	50 sec
Line contact property		30 $\mu$ m	60 $\mu$ m	50 $\mu$ m	70 $\mu$ m
Difference in the test mask size		0.5 $\mu$ m	8.1 $\mu$ m	0.8 $\mu$ m	10.2 $\mu$ m

7. Referring to Table 1, the "Acrylic" compositions (1) and (2) were as follows:

Acrylic (1): A 40% by weight, methyl ethyl ketone solution of an acrylic copolymer with copolymerization ratios among methyl methacrylate, butyl methacrylate, benzyl methacrylate and methacrylic acid of 10/35/30/25 on weight basis (weight average molecular weight = 70,000, acid value = 190).

Acrylic (2): A 40% by weight, methyl ethyl ketone solution of an acrylic copolymer with copolymerization ratios among methyl methacrylate, butyl

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methacrylate and methacrylic acid of 30/45/25 on weight basis (weight average molecular weight = 80,000, acid value = 180).

8. Referring to Table 1, the "Urethane" compositions (1) and (2) were as follows:

Urethane (1): A 70% by weight, methyl ethyl ketone solution of SSUA8AL-MH (manufactured by KYOEISHA (name of company)) which has a polyether structure in the main chain and an aliphatic diisocyanate (hexamethylene diisocyanate) structural unit.

Urethane (2): A 70% by weight, methyl ethyl ketone solution of UAS-C34 (manufactured by KYOEISHA) which has a polyether structure in the main chain and an aromatic diisocyanate (xylene diisocyanate) structural unit.

9. The following results are set forth in Table 1:

Sandblasting Resistance O: The composition exhibited good resistance  
X: The composition did not exhibit good resistance

Layer Disappearance time      The longer the disappearance time, the more sandblasting resistance.

Developability      O: good  
                        A: poor

Line contact property      The fine lines exceeding the designated line width are faithfully reproduced without coming off or zigzag. The finer line widths are the better.

Difference in the test mask size:      Smaller differences are better.

10. The results shown in Table 1 indicate:

(a) that Acrylic (1), which contains a benzene ring, exhibits a better line contact property and a smaller difference in the test mask size than Acrylic (2), which does not contain a benzene ring;

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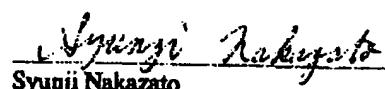
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(b) that Urethane (1), which contains a structural unit of aliphatic diisocyanate, exhibits a higher sandblasting resistance than Urethane (2), which contains a structural unit of aromatic diisocyanate; and

(c) that Composition (1), which was made from Acrylic (1) and Urethane (1), had unexpectedly superior results in (i) the line contact property, (ii) the difference in the test mask size and (iii) the sandblasting resistance, as compared to the other compositions.

11. I declare under penalty of perjury that the foregoing is true and correct.

Executed in Kanagawa, Japan, on November 11, 2004.

  
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Syunji Nakazato

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